ALLOWABLE AREAS WORKSHEET

AREA MODIFICATIONS TO TABLE 503

Allowable area = Tabular area + Frontage increase + Sprinkler increase

$A_a = A_t + [(A_t)(I_f)/100] + [(A_t)(I_s)/100] =$ _____

A_a = Allowable area per floor

A_t = Table 503 area per floor

I_f = Area increase due to frontages = (100)[F/P – 0.25](W/30)

I_s = Area increase due to complete sprinkler protection (NFPA 13)

F = Building perimeter which fronts an open space having a minimum width of 20 feet

P = Perimeter of the entire building

W = Minimum width of open space for frontage exposure on any side

Sprinkler increase

I_s = Sprinkler increase for one-story buildings = 300 percent

I_s = Sprinkler increase for multi-story buildings = 200 percent

I_s = Building not completely sprinkler protected = 0 percent

Frontage calculation **(note that frontage is only permitted on open space that is a public way or**

space that is a minimum 20 feet wide which is accessed from a street or fire lane)

	_____	_____	_____	_____
Building frontage lengths	North wall	East wall	South wall	West wall
Minimum width of open space	_____	_____	_____	_____

Minimum width of open space (W) = _____ (least of above ≥ 20 feet)

Total building frontage (F) = _____ (total of above four frontages)

Total building perimeter (P) = _____ (total of four building sides)

Area increase due to frontages I_f = (100)[F/P – 0.25](W/30) = _____

ALLOWABLE AREAS WORKSHEET

(One story per worksheet – add additional worksheets as necessary)

STORY LOCATION	*USE GROUP*	*ACTUAL FLOOR AREA*	*TABLE 503 AREA*	*MODIFIED AREA ALLOWABLE*	*RATIO* *Actual/Allowable*
				TOTAL OF ALL RATIOS =	

Must be ≤ 1.0

MAXIMUM AREA DETERMINATION OF BUILDING **(check only required if > 3 stories)**

Total floor area of the building (all stories) = _____ *(the actual building total square feet)*

Largest value of allowable area (any story) = _____

Allowable floor area of building (IBC 503.3) = _____ *(3 times the maximum modified area)*

Is actual total area less than maximum allowable area? _____

Note that this IBC 503.3 check is still under review for compliance with IBC intent. This BOCA method shown will not meet ICBO interpretation for compliance to IBC 503.3 check.

WORKSHEET INSTRUCTIONS

This worksheet is only needed if there is more actual building area than the value shown in Table 503.

ALLOWABLE AREAS WORKSHEET

AREA MODIFICATIONS TO TABLE 503

A_a = Allowable area per floor = $A_t + [(A_t)(I_f)/100] + [(A_t)(I_s)/100]$ = _____

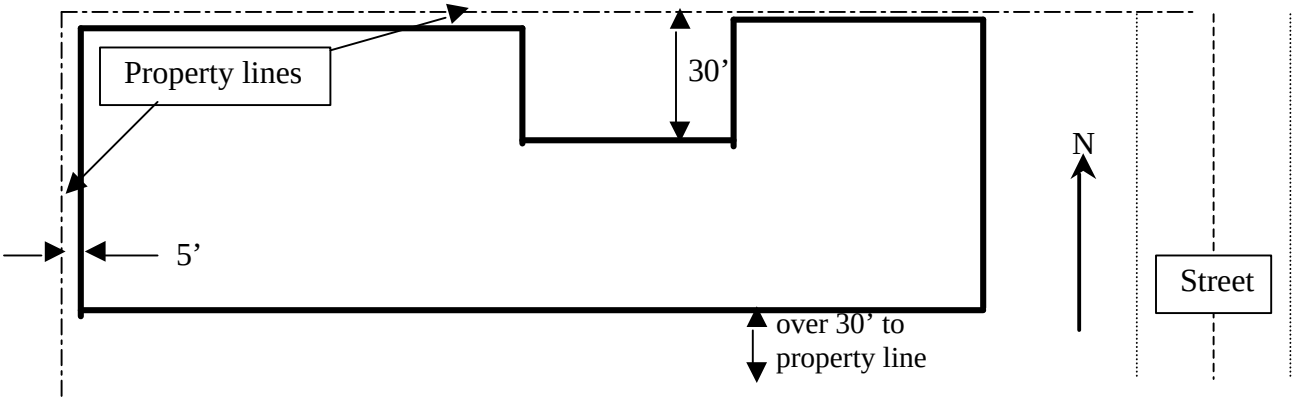
Base value of table area is always permitted (thus A_t). The second part of the equation is the frontage increase $[(A_t)(I_f)/100]$. The third part of the equation is sprinkler increase $[(A_t)(I_s)/100]$.

A_t = Table 503 area per floor for the occupancy group and type of construction of the building.
If more than one occupancy group, use the most restrictive of non-separated uses shown.

I_f = Area increase due to frontages = (100)[F/P – 0.25](W/30)

Maximum increase due to frontages is 75%, this is when the full perimeter has at least 30' open space.

F = Frontage of a building perimeter which fronts an open space having a minimum width of 20 feet, the open space could be a public way or could be a yard on the property that leads to a street or approved fire lane (see COMM 62.0500 for fire apparatus access requirements). If a 20-foot or more wide yard is provided, but no access to that yard by fire-fighting equipment is provided, then no credit can be taken for that portion of the perimeter (see this example of this below).



In the above example only the south and east frontage areas can be used to calculate an area increase, as even though the north wall has some area with over 20 feet of open space, it does not have fire access to that open space.

P = Perimeter of the building measured at exterior walls of entire building or measured per IBC 503.1 at exterior walls and fire walls (used to create separate buildings for area limitations). If a fire wall is used to create separate buildings, the fire wall length is counted along with the other exterior walls.

W = Width of open space for frontage exposure on any side. Minimum width to be counted is 20 feet. Maximum permitted width counted is 30 feet. The side with the smallest W is used in the calculation.

I_s = Area increase due to complete sprinkler protection *This is either* 200% *or* 300% *or* 0. Sprinkler increase is only permitted for complete sprinkler system per Section 903.3.1.1 *(NFPA 13)* in the building. Sprinkler increase for one-story buildings is 300 percent, increase for multi-story buildings is 200 percent.

WORKSHEET INSTRUCTIONS

ALLOWABLE AREAS WORKSHEET

Provide only one story per worksheet, use a separate worksheet page for additional stories as necessary. Provide the information in first through fourth columns for each occupancy (see the examples on pages following). Then enter in fifth column the allowable area as modified by the equation from the previous part of this two-page worksheet. Then divide third column by fifth column and put answer in sixth column.

STORY LOCATION	*USE GROUP*	*ACTUAL FLOOR AREA*	*TABLE 503 AREA*	*MODIFIED AREA ALLOWABLE*	*RATIO* *Actual/Allowable*

TOTAL OF ALL RATIOS =

Must be ≤ 1.0

Add the sum of all of the ratios in the sixth column and place the total in this location. The story passes area requirement if the total is 1.0 or less, it fails area limit if it exceeds 1.0 total value here.

A check below is preformed once for the entire building, if using multiple sheets, you only need do it once.

MAXIMUM AREA DETERMINATION OF BUILDING **(check only required if > 3 stories)**

Total floor area of the building (all stories) = _____ *(the actual building total square feet)*

Largest value of allowable area (any story) = _____ *(highest value in any above column 5)*

Allowable floor area of building (IBC 503.3) = _____ *(3 times the maximum modified area)*

Is actual total area less than maximum allowable area? _____ *[Answer **no** if allowable (third entry) exceeds actual (first entry) and answer **yes** if allowable (third entry) exceeds actual total (first entry).]*

Note that this IBC 503.3 check is still under review for compliance with IBC intent. This BOCA method shown will not meet ICBO interpretation for compliance to IBC 503.3

Design Example W (for the ALLOWABLE AREAS WORKSHEET)

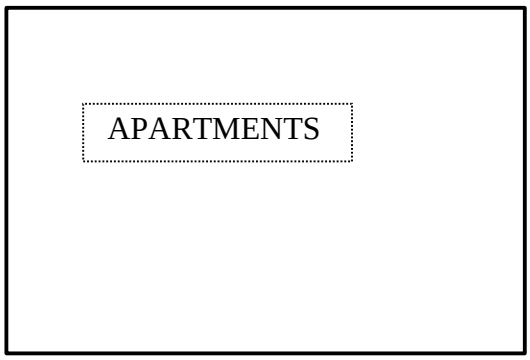
A building of 200' x 250' size is shown and is four stories tall, completely sprinkler protected type IIIA construction with separated uses. The first story is all retail use and fourth story is apartments. Second story is mixed use of 200' x 100' retail, 150' x 150' offices with 40' x 50' conference and 50' x 50' lunchrooms, and 150' x 50' day care. The third story is evenly divided mixed use of vocational technical school and library. No allowable frontage increase is possible for this lot. *Does it comply?*

Since the first and fourth stories have only one use each, only second & third floors need this worksheet.

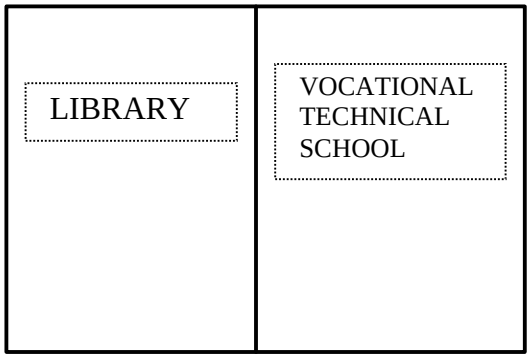
It is implied that if there is only one occupancy on a story, then the second page of allowable area worksheet will not be needed. That story can be directly compared using first page of worksheet, allowable area modification sheet alone, without the second page (except > 3 story).

Since the first floor is only one occupancy *(Retail)* Group M, this worksheet would not be needed for that level. You would only need to compare the modified allowable area for Group M to the actual area of the floor level. In this case allowable area of 55,500 SF is greater than actual 50,000 SF, thus first floor area complies.

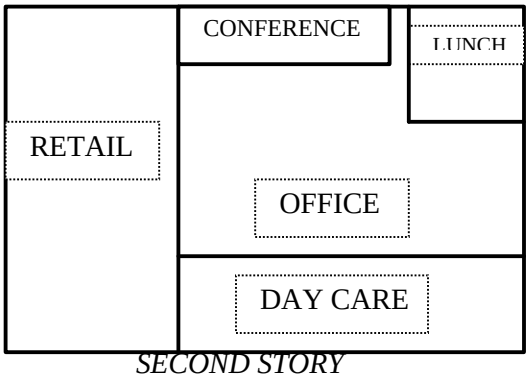
The same way would be used for the fourth floor. As the allowable area of 72,000 SF for the sprinkler protected apartments R-2 occupancy exceeds the actual 50,000 SF of fourth floor, it complies too.



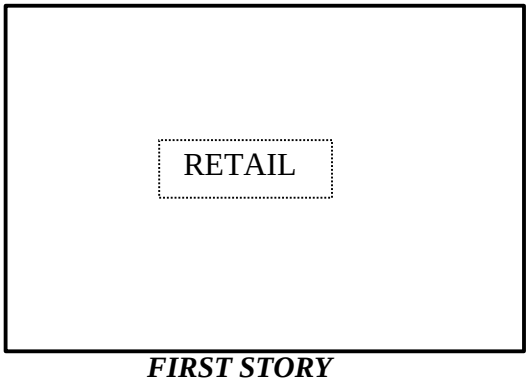
FOURTH STORY



THIRD STORY



SECOND STORY



FIRST STORY

Design Example W (continued)

ALLOWABLE AREAS WORKSHEET

One story per worksheet, since example building is multi-story, we use multiple copies of the worksheet.

STORY LOCATION	*USE GROUP*	*ACTUAL FLOOR AREA*	*TABLE 503 AREA*	*MODIFIED AREA ALLOWABLE*	*RATIO* *Actual/Allowable*
Second west	***M***	***20,000***	***18,500***	***55,500***	***0.36***
Second South	***E***	***7,500***	***23,500***	***70,500***	***0.11***
Second center	***B***	***18,000***	***28,500***	***85,500***	***0.21***
Second Northwest	***A-3***	***2,000***	***14,000***	***42,000***	***0.05***
Second Northeast	***A-2***	***2,500***	***14,000***	***42,000***	***0.06***
				TOTAL OF ALL RATIOS =	***0.79*** $\leq$ *1.0*

ALLOWABLE AREAS WORKSHEET

STORY LOCATION	*USE GROUP*	*ACTUAL FLOOR AREA*	*TABLE 503 AREA*	*MODIFIED AREA ALLOWABLE*	*RATIO* *Actual/Allowable*
Third East	***B***	***25,000***	***28,500***	***85,500***	***0.29***
Third West	***A-3***	***25,000***	***14,000***	***42,000***	***0.60***
				TOTAL OF ALL RATIOS =	***0.89*** $\leq$ *1.0*

MAXIMUM AREA DETERMINATION OF BUILDING **(check only required if > 3 stories)**

Total floor area of the building (all stories) = **200,000** *(the actual building total square feet)*

Largest value of allowable area (any story) = **85,500** *(this is the modified allowable area)*

Allowable floor area of building (IBC 503.3) = **256,500** *(3 times the maximum adjusted area)*

Is actual total area less than maximum allowable area? ***YES*** ***thus compliant***

Using BOCA the method.

Note that you do not simply add the ratios of all floors together to determine compliance. If you did that for this example, the total of 0.90 + 0.79 + 0.89 + 0.69 = 3.27 *would appear to exceed the maximum three times the allowable area permitted in IBC 503.3 requirement.*

Note that in the above example, if using non-separated uses, then most restrictive value would apply to each floor, but still the largest value allowed for any floor would still be used.

If using ICBO interpretation of the IBC 503.3 check.

Design Example X

WORKSHEET INSTRUCTIONS

☑ I am using a **combination of separated and non-separated uses** in my design.

Care must be exercised in filling in the proper allowable area for the non-separated uses in the worksheet, as the more restrictive area limit will apply to both occupancies without rated walls.

Example X is the same building as in previous Example W, except there is **not** a rated separation between the office, conference room, and lunchroom on the second floor (all other rated separations remain between all occupancies).
*(Previous **Example W** was 200' x 250' building is four stories completely sprinkler protected type IIIA construction with all uses separated. The first story is all retail use and fourth story is apartments. Second story is mixed use of 200' x 100' retail, 150' x 150' offices with 40' x 50' conference and 50' x 50' lunchrooms, and 150' x 50' day care. The third story is evenly divided mixed use of vocational technical school and library. No frontage increase possible for this lot.)*

ALLOWABLE AREAS WORKSHEET

You would fill out the sheet the same as before, except combine areas shown below. There the allowable area for the A-2 & A-3 would be used for the combined B, A-2, & A-3 occupancy, as it has no separation.

STORY LOCATION	*USE GROUP*	*ACTUAL FLOOR AREA*	*TABLE 503 AREA*	*MODIFIED AREA ALLOWABLE*	*RATIO* *Actual/Allowable*
Second west	***M***	***20,000***	***18,500***	***55,500***	***0.36***
Second South	***E***	***7,500***	***23,500***	***70,500***	***0.11***
Second center Northwest, & Northeast	***B, A-2, A-3***	***22,500***	***14,000***	***42,000***	***0.54***
				TOTAL OF ALL RATIOS =	***1.01*** *> 1.0* **Thus FAILS !**

As we see that the second floor sum of the ratios **fails to be less 1.0**, that **design will not be acceptable**. Thus we can see that having to use the most restrictive requirements for non-separated uses will sometimes cause design problems that will need an alternate solution. As the second floor failed, one would not have to check the other floors, as the design is unacceptable. A revised design would be needed to provide compliance, thus you would test a different design.

As Example X failed, try again with mixed separated and non-separated uses, this time try design (Example Y) of the retail, office, and daycare without a rated separation from each other, but still separated from the other floors and from second floor assembly occupancies (lunch rooms & conference room) with rated construction.

Design Example Y

Example Y is the same building as in previous Example W, except there is **no** rated separation between the office, retail, and daycare on the second floor (all other rated separations remain).

Care must be exercised in filling in the proper allowable area for the non-separated uses in the worksheet, as the more restrictive area limit will apply to both occupancies without rated walls.

ALLOWABLE AREAS WORKSHEET

You would fill out the sheet the same as before, except where arrows shown below.

STORY LOCATION	*USE GROUP*	*ACTUAL FLOOR AREA*	*TABLE 503 AREA*	*MODIFIED AREA ALLOWABLE*	*RATIO* Actual/Allowable
Second west, center, & south	***M, E, B***	***45,500***	***18,500***	***55,500***	***0.82***
Second Northwest	***A-3***	***2,000***	***14,000***	***42,000***	***0.05***
Second Northeast	***A-2***	***2,500***	***14,000***	***42,000***	***0.06***
			TOTAL OF ALL RATIOS =		***0.93*** $\leq$ *1.0*

And the second sheet, the same as example W, would be as follows.

ALLOWABLE AREAS WORKSHEET

STORY LOCATION	*USE GROUP*	*ACTUAL FLOOR AREA*	*TABLE 503 AREA*	*MODIFIED AREA ALLOWABLE*	*RATIO* Actual/Allowable
Third East	***B***	***25,000***	***28,500***	***85,500***	***0.29***
Third West	***A-3***	***25,000***	***14,000***	***42,000***	***0.60***
			TOTAL OF ALL RATIOS =		***0.89*** $\leq$ *1.0*

MAXIMUM AREA DETERMINATION OF BUILDING **(check only required if > 3 stories)**

Total floor area of the building (all stories) = _**200,000** *(the actual building total square feet)*

Largest value of allowable area (any story) = _**85,500**_ * *(this is the modified allowable area)*

Allowable floor area of building (IBC 503.3) = _**256,500** *(3 times the maximum adjusted area)*

Is actual total area less than maximum allowable area? _***YES***_ *thus compliant*

*So we can see from this example of combination of separated and non-separated uses, it would be okay to leave some occupancies open to each other, while needing a rated separation to others. * Also note in this case even though the second floor no longer has the 85,500 SF allowance, but the third floor still does, thus you do not have to change the IBC 503.3 check.*

Design Example Z

Example Z is the same building as in previous Example W, except there is not a rated separation between the office, retail, and daycare on the second floor; there is not a separation between the second floor lunch rooms and third floor library; there is not a separation between whole second floor and first floor (except it is provided at conference & lunch room floors); and there is not a separation between the fourth floor and the vocational school (all other rated separations remain).

Care must be exercised in evaluating the proper allowable area for each of the non-separated uses in the worksheet, as the more restrictive area limit will apply to both occupancies without rated assemblies.

ALLOWABLE AREAS WORKSHEET

You would fill out the sheet the same as before in Example W, except where arrows show below.

STORY LOCATION	*USE GROUP*	*ACTUAL FLOOR AREA*	*TABLE 503 AREA*	*MODIFIED AREA ALLOWABLE*	*RATIO* Actual/Allowable
Second west, center, & south	***M, B, E***	***45,500***	***18,500***	***55,500***	***0.82***
Second Northwest	***A-3***	***2,000***	***14,000***	***42,000***	***0.05***
Second Northeast	***A-2***	***2,500***	***14,000***	***42,000***	***0.06***
			TOTAL OF ALL RATIOS =		***0.93*** $\leq$ *1.0*

Thus second story is still compliant.

For the third floor east side, since there is no separation to the fourth floor, use the R-2 area for that half.

ALLOWABLE AREAS WORKSHEET

STORY LOCATION	*USE GROUP*	*ACTUAL FLOOR AREA*	*TABLE 503 AREA*	*MODIFIED AREA ALLOWABLE*	*RATIO* Actual/Allowable
Third East	***B [R-2]***	***25,000***	***24,000***	***72,000***	***0.35***
Third West	***A-3***	***25,000***	***14,000***	***42,000***	***0.60***
			TOTAL OF ALL RATIOS =		***0.95*** $\leq$ *1.0*

Thus third story is still compliant.

Also note that first floor ratio is still 0.90 and fourth floor ratio is still 0.69, thus are still compliant.

MAXIMUM AREA DETERMINATION OF BUILDING **(check only required if > 3 stories)**

Total floor area of the building (all stories) = _**200,000** *(the actual building total square feet)*

Largest value of allowable area (any story) = _**72,000** (*modified allowable is now lower)*
Note that the largest modified allowable area is now the fourth floor allowance of 72,000 square feet.

Allowable floor area of building (IBC 503.3) = _**216,000** *(3 times the maximum adjusted area)*

Is actual total area less than maximum allowable area? _***YES*** *(but not by as much as before)*